

4 Services provided by nature

- 4.1 This section provides evidence about the different services provided by nature. Specific services may be of interest to different policy makers and practitioners, so you may choose to focus just on those. Alternatively, you may be interested in overarching themes such as economic competitiveness, so [Chapter 2](#) and [Chapter 3](#) may be useful in identifying how the environment contributes to those themes.
- 4.2 It is important to note that not all services provided by nature are included here. The ones chosen are the ones which on the basis of current evidence are most important in the context of environmental projects. The ones selected are also those for which we have available scientific and economic evidence.

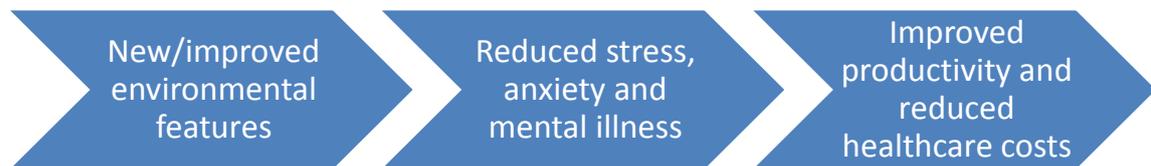
4f Mental health

There is good evidence that people with better access to the natural environment tend to be happier and less prone to mental illness. Insufficient evidence exists to explain exactly why this effect occurs, as several pathways may be involved.

Introduction

- 4.30 This section presents evidence that exposure to natural environments has psychological benefits, particularly with regard to stress levels and mood. This includes the psychological benefits of exercise taken in a natural environment as opposed to in an unnatural one.
- 4.31 Evidence of a positive effect on mental health is important because mental health is a major health issue in England with a strong negative impact on the economy. Tackling chronic stress is important because it plays a major role in the causation and development of common physical and mental illnesses, and the problem has been intensifying in recent decades (Health Council of the Netherlands 2004)⁸⁰.
- 4.32 The economic and social costs of mental illness in England are estimated at £105.2 billion for the year 09/10. This includes direct costs of healthcare of £21.3 billion, and £30.3 billion in lost output (Centre for Mental Health 2010)⁸¹.
- 4.33 A rigorous sample based survey suggests 1 in 6 people in the UK have depression or chronic anxiety disorder with just under 1 in 4 people suffering from some form of mental illness (McManus and Bebbington 2009)⁸².

Theory of change



- 4.34 Note that this is a highly simplified theory of change, as the natural environment may impact on people's mental health both directly and indirectly (through for instance, encouraging physical activity and social interaction, both of which are linked to mental health). In addition, as shown above, the theory of change could potentially also be taken a step further to examine the flow-on impact of a happier, healthier population, in terms of improved productivity and reduced medical expenditure. This is not examined in this review.

⁸⁰ The comments in the report refer primarily to Dutch society, but may be reasonably applicable to the UK. On the basis of these comments the report argues that chronic stress should have a profile in public health policy similar to that of alcohol and smoking.

⁸¹ Note that the £105.2 billion figure is an economic VALUE estimate and so cannot be compared to GDP figures. The approach taken includes valuing unpaid work and also quality of life years lost and therefore must be regarded as a best estimate, and in future could be improved upon in terms of methodology and data availability. However the approach taken is appropriate and conservative.

⁸² The nearly 1 in 4 figure is actually 23% and includes people suffering from post-traumatic stress disorder, suicidal thoughts, suicide attempts and self-harm, psychosis, anti-social and borderline personality disorders, attention deficit and hyperactivity disorders, eating disorders, alcohol misuse and dependence, drug-use and dependence, gambling and behavioural problems.

Can the benefit be quantified?

4.35 Quantification of these relationships is complex because of the very individual nature of mental distress, and difficulties defining and comparing levels of mental distress across different people. The only robust empirical route is through a longitudinal study examining changes in people's mental health over time. This would have to be quasi-experimental, because randomly assigning people to groups over the long term would contravene ethical requirements. This however limits the ability of researchers to control for all the relevant variables influencing mental health.

How strong is the evidence?

4.36 The evidence for the natural environment contributing to mental health is strong. Much of the existing research is cross-sectional, examining differences in mental health across groups of individuals. Some longitudinal research examining differences in the mental health of individuals across time is also available, and combined, these two forms of evidence are convincing.

4.37 The exact pathways through which the natural environment contributes to mental health are unclear. Ward Thompson, Roe et al. (2012) suggest that there are three pathways through which the natural environment can contribute to improvements. The first is directly through the restorative benefits provided by exposure to nature, and the second is indirectly through providing a space for positive social contact. The third pathway is through providing a space for physical activity.

Evidence

Exposure to nature

- There is strong evidence, from a large number of high-quality studies that nature promotes recovery from stress and attention fatigue, and that it has positive effects on mood, concentration, self-discipline, and physiological stress (Health Council of the Netherlands 2004) [for examples see (Kaplan and Kaplan 1989); (Berman, Jonides et al. 2008), (Ulrich 1984) and (Ulrich, Simons et al. 1991)].
- In healthy people, the stress hormone cortisol is at its peak level in the morning and declines during the day. The rate at which it declines reflects the level of stress the person is exposed to throughout the day (less stress results in a faster rate of decline). An exploratory study of disadvantaged residents of Dundee, UK, found that people living in areas with more greenspace had cortisol levels in their saliva which declined significantly faster than in those people with less access to greenspace. The same people also reported lower levels of self-perceived stress (Ward Thompson, Roe et al. 2012)⁸³.
- Alcock, White et al. (2014) used British Household Panel Survey data between 1991 and 2008 to examine the mental health of 1,064 British residents who moved house during that time. Of these people, 594 moved from less to more green areas, and 470 moved from more to less green areas. Each respondent reported their mental health each year using the Generalised Health Questionnaire. Respondents living in more green areas reported average mental health higher than those in less green areas. Respondents in less green areas who moved to greener areas reported an improvement in mental health in the first year, which was sustained in the following two years. Respondents in more green areas who moved to less green areas reported a decline in mental health in the year prior to the move, followed by rapid adaptation and a return to previous mental health (Alcock, White et al. 2014)⁸⁴.

⁸³ This was an exploratory study with 25 participants aged between 35 and 55, none of whom were in employment. Results therefore may not be applicable to the wider UK population. Ward Thompson, Roe et al. 2012 selected this group for study because research suggests that greenspace has a disproportionately beneficial effect on the health of deprived communities.

⁸⁴ Respondents completed the General Health Questionnaire to determine their mental health status. 'Greenness' was derived from land cover identified in the Generalised Land Use Database for the 4km² land parcel in which the

- In a Norwegian study of patients in a heart and lung rehabilitation centre, men with unobstructed mountain views from their private room noted increases in self-reported mental health over a 4 week period, compared with men in rooms with an obstructed view. The same effect was not found for women (Raanaas, Patil et al. 2011)⁸⁵.
- A study examining two comparable neighbourhoods in Ghent, Belgium found that the people living in the neighbourhood with more greenery (including private gardens and street trees) were happier than those in the comparison neighbourhood. However, satisfaction with the amount of neighbourhood greenery was not directly significant in determining happiness. Instead the relationship was found to be less obvious – the amount of greenery influenced the green view from an individual's living room window, which was highly correlated with the level of neighbourhood satisfaction, which in turn was highly correlated with individual happiness levels (Herzele and Vries 2012)⁸⁶.
- The Mappiness project developed at the London School of Economics uses an iPhone application to track individual's happiness over time and across locations. This found that average happiness was 60.7 (scored out of 100). This increased by 2.3 points when an individual was outside, and a further 6 points if the individual was in a marine or coastal area (compared to an urban area). All other land cover types and outdoor activities also increased happiness, but to a lesser extent (MacKerron and Mourato 2013)⁸⁷. Social interactions were controlled for in the analysis.
- Children in Swedish preschools with vegetated outdoor play areas were found to be more attentive than children without such play areas. Hyperactivity and impulsivity were also found to be reduced in children with vegetated play areas (Martensson, Boldemann et al. 2009)⁸⁸.
- Evidence from Australia suggests that greenspace quality may be more important to mental health than its quantity. People living near moderate or high quality public open spaces were found to be twice as likely to report low psychological distress as those living near low quality spaces. Usage of greenspace, and number and size of greenspaces was not significantly related to mental health (Francis, Wood et al. 2012)⁸⁹.

Social interactions

- Researchers in the Netherlands found that the amount of greenspace was correlated with people's feelings of loneliness and perceptions of social support, and that this in turn was correlated with self-reported propensity for psychiatric illness. However, there was no

individual's home was located. The interesting results for people moving from green to less green areas could possibly be explained by individuals being overly pessimistic about the effects of moving house, and recovering quickly when this is realised.

⁸⁵ It is unclear from the study if men spent a higher proportion of their time in their rooms rather than in communal areas, and whether this contributed to the gender disparity. The study examined a short time period only and therefore did not identify whether the differences hold once patients leave the centre.

⁸⁶ The results of this study were based on a relatively small sample of less than 200 people. It is also possible that the neighbourhoods differed in ways which were not observed in the study, therefore influencing the results.

⁸⁷ This study did not use random sampling, as all participants were self-selected. This may influence the results. The direction of causation is also difficult to prove – the study authors note that people may choose certain locations depending on their mood.

⁸⁸ This study involved 200 Swedish children and 11 preschools. Attention, hyperactivity and impulsivity were assessed by their teachers using the Early Childhood Attention Deficit Disorders Evaluation Scale. Children in preschools where children were outdoors all day were excluded from the analysis.

⁸⁹ Survey respondents were people who moved into new residential developments in Perth, Western Australia. They completed a standard Kessler 6 questionnaire on mental health, which separated them into two groups – those with low risk of psychological distress, and those with medium-high risk. Public open space quality was objectively measured using 10 attributes including walking paths, shade, water features, bird life and playgrounds.

evidence of an increase in actual social contacts or social support received in areas with more greenspace (Maas, Dillen et al. 2009).

Access and physical activity

- Between 1999 and 2005, a Swedish longitudinal study of over 10,000 residents was conducted, which found that greenspace attributes had no independent relationship with mental health. However, the study found that women who were physically active in 1999 and lived near 'serene' natural environments were 80 per cent less likely to have poor mental health in 2005, compared with those who were neither physically active nor living near 'serene' environments. A similar result was found for men, but this was not statistically significant (i.e. it may have been due to chance). Participants who were physically active on a regular basis but not living near 'serene' environments were only 10 per cent less likely to have poor mental health in 2005 than those who were not physically active, suggesting that the interaction between physical activity and the natural environment is important in determining mental health outcomes (Annerstedt, Ostergren et al. 2012)⁹⁰.
- On the specific issue of whether exercise in greenspace had mental health benefits greater than indoor exercise, a systematic review of the evidence for the mental health benefits of taking exercise in greenspace found significant reductions in anger, fatigue and depression, but concluded that there was not yet enough evidence to make generalized statements of universal benefit (Bowler, Buyung-Ali et al. 2010).
- Guite et al. (2006) performed a study in Greenwich, London, looking at the local environment in its broadest sense (i.e. fear of crime, noise etc) and concluded that being dissatisfied with access to open greenspace is related to mental ill-health in a statistically significant manner⁹¹.

Effects of increased naturalness

- The evidence in this area is not as developed as for the benefits of greenspace in general, but there is a study which found increased psychological benefit for greenspaces with high levels of biodiversity (Fuller, Irvine et al. 2007)⁹². Additionally a study in Montpellier, France found that 72% of respondents preferred natural to ornamental greenspaces (Caula, Hvenegaard et al. 2009)⁹³.
- Conflicting evidence from Sweden found study participants were able to identify areas of greater biodiversity (defined as species richness), yet these areas were actually most

⁹⁰ The study excluded respondents who moved house within the 6 year time period, but did not reassess the available greenspace in 2005. It is unlikely that this would make a significant difference to the results, as urban greenspace availability is not likely to have changed much over that period.

⁹¹ In this study the survey was not sent randomly, but based on a previously held theoretical model of domains which might influence mental health. A wide range of possible confounding variables was considered. Given practical and ethical constraints this may be as close to a genuine experiment as is possible for long-term study.

⁹² This study assessed biodiversity and self-reported psychological responses on a robust basis in parks in Sheffield. It found that park-users perceptions of plant biodiversity were strongly related to objective measures, for birds there was the appearance of a relationship, but it wasn't strong enough to be statistically significant, and for butterflies there was no clear relationship. The degree of psychological benefit was positively related to the species richness of plants. Obviously, it was not possible to control whether people with a greater propensity to psychological benefit from greenspace choose to visit more biodiverse parks, so this is a potential confounder. The findings suggest that park management emphasizing a mosaic of habitats would benefit biodiversity and the psychological wellbeing of park visitors.

⁹³ This peer-reviewed study was based on a self-completed study distributed to community centres in Montpellier. Appropriate comparisons between those completing the survey and population were made and the sample proved to be broadly comparable to the population, but contains a smaller percentage of people with lower levels of education. The study also found that for those most interested in urban biodiversity, and for those that make the most use of greenspaces, providing information about the importance of greenspaces for biodiversity increased willingness to pay for natural greenspaces.

disliked. Ornamental park landscapes were found to be more desirable (Qiu, Lindberg et al. 2013)⁹⁴.

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⁹⁴ This study was conducting using 69 student participants aged between 22 and 43. It is possible that their ecological knowledge was therefore higher than the general population, yet they still exhibited a preference for less biodiverse landscapes. This may be because biodiverse landscapes tend to look 'messy' and less inviting than less biodiverse landscapes such as green lawns.

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